Simpson®

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

MODEL 388-3L
THERM-O-METER

E2837
D11

WARNING

For safe usage, it is essential that the operator read this manual carefully before using the instrument for any measurements.

SIMPSON ELECTRIC COMPANY
A Katy Industries Subsidiary
853 Dundee Avenue, Elgin, Illinois 60120
(312) 697-2260 • Cable SIMELCO • Telex 72-2416
IN CANADA: Bach-Simpson, Ltd., London, Ontario
IN ENGLAND: Bach-Simpson (U.K.) Ltd., Wadebridge, Cornwall

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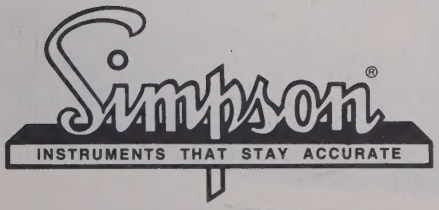

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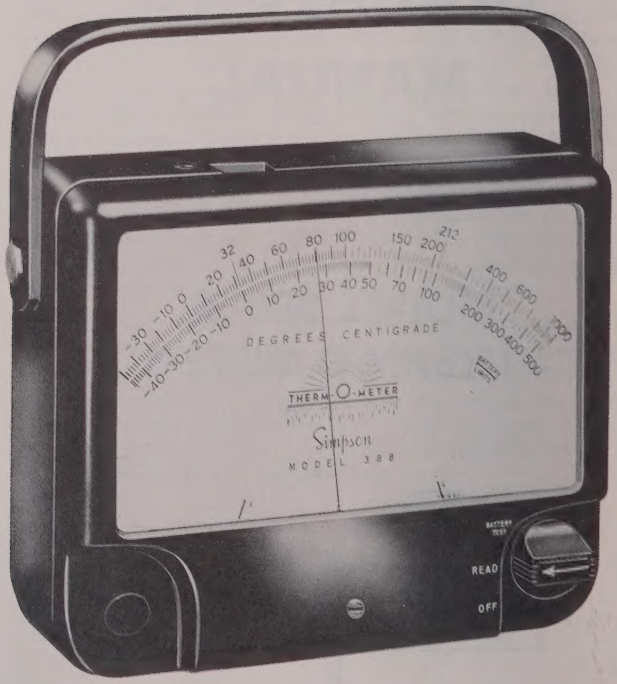

Figure 1-1. Model 388-3L Therm-O-Meter

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SECTION I

INTRODUCTION

1.1 GENERAL

The Simpson Model 388-3L Therm-O-Meter (hereafter referred to as the Model 388-3L or as the Instrument) is a self-contained electrically operated temperature indicator (see Figure 1-1).

1.2 DESCRIPTION

1.2.1 This Instrument has a wide range of applications. Its large 7-inch meter is calibrated in Fahrenheit and centigrade for direct temperature indication. The standard range includes temperature indications from −50°F to +1000°F (−40°C to +500°C). Kelvin scales are available on special order.

1.2.2 The Instrument is especially suited for measuring the temperature of an enclosed space. The thermocouple tip is placed inside the enclosed space and the meter can be located nearby where it can provide instant readings obvious to the operator. All test indications can be continuous over a long period of time or in the nature of a spot check at any time. There is a very short lag to be measured and the correct indication appears on the meter. However, it is necessary to stabilize the instrument at the temperature of the environment before taking readings.

1.2.3 The Model 388-3L is provided with a single thermocouple lead (temperature probe). However, the Instrument has provision for three leads, which allows simultaneous temperature measurements of three different locations within the same vicinity through a selector switch. All three leads can be attached to the Instrument at the same time. Multiple testing is especially valuable for laboratory control, production equipment and many types of experimental applications. Each thermocouple lead is 8-feet long with a polarized plug on one end and a thermo-junction at the other end. These optional leads are listed in Table 7-2.

1.2.4 A battery is used to power the compensating network, which consists of a bridge circuit through which the current passes. A thermistor senses the temperature changes and unbalances the bridge, which starts the current flow.

1.3 TECHNICAL DATA

Table 1-1 lists the technical data for Model 388-3L.

Table 1-1. Technical Data

1. Temperature Range:	−50°F to +1000°F (−40°C to +500°C).
2. Accuracy:	To within 1-1/2 scale divisions.
3. Instrument operating Temperature Limits:	60°F to 100°F.
4. Length of Test Leads:	8-feet with polarized plug.
5. Dimensions:	7-15/16″W x 6″H x 2-15/16″D (203mm x 152mm x 76mm).
6. Weight:	3 lbs. (1.36 kg.).

SECTION II

PREPARATION FOR USE

2.1 UNPACKING AND INSPECTION

If shipping carton is in good condition, then unpack and inspect the Instrument for possible damage incurred during ship ment. If damage is noted, notify the carrier and supplier and do not attempt further use of the Instrument. If Instrument appears to be in good condition, read Operator's Manual in its entirety. Become familiar with the Instrument as instructed in the manual, then proceed to check the electrical performance as soon as possible. Also check that all items are included in the shipment (see Table 7-1).

2.2 POWER REQUIREMENTS

The Model 388-3L operates from the output voltage of the thermocouple temperature probe. A 1.5-volt battery Burgess No. 2 "D" size or Eveready #950 "D" size or equivalent, is used to provide thermocouple cold junction compensating voltage to the instrument bridge network.

2.3 INSTALLATION

The Instrument can be set horizontally or vertically. Using the handle as a support, it can be placed in a convenient sloping position. While the Instrument will operate in any position, to maintain the factory accuracy of 1-1/2 scale divisions within a range it must be operated in a horizontal position. The handle is furnished for carrying, or supporting the Instrument during bench use.

SECTION III

CONTROLS, CONNECTORS AND INDICATOR

3.1 GENERAL

This section provides specific instructions about the various controls on the Model 388-3L. Become thoroughly familiar with the function of each control before operating the Instrument for the first time.

3.2 DESCRIPTION

All operating controls, connectors and indicator are listed in Table 3-1. The item callouts in Figure 3-1 correspond with the numerical sequence of the items listed in Table 3-1.

Table 3-1. Controls, Connectors and Indicator

1. Handle:	Used for carrying the Instrument. Provides sloping position for bench operation.
2. Case:	High impact plastic case.
3. Compensating Circuit Switch: ←	Three position switch used to select mode of operation.
a. OFF:	The thermocouple compensating bridge circuit is opened, no correction voltage is applied to the meter. Any temperature difference between the two ends of the thermocouple lead (if it is plugged in) will result in a voltage, which will deflect the meter pointer from 80°F.
b. READ:	In this position the thermocouple compensating bridge circuit will correct the meter

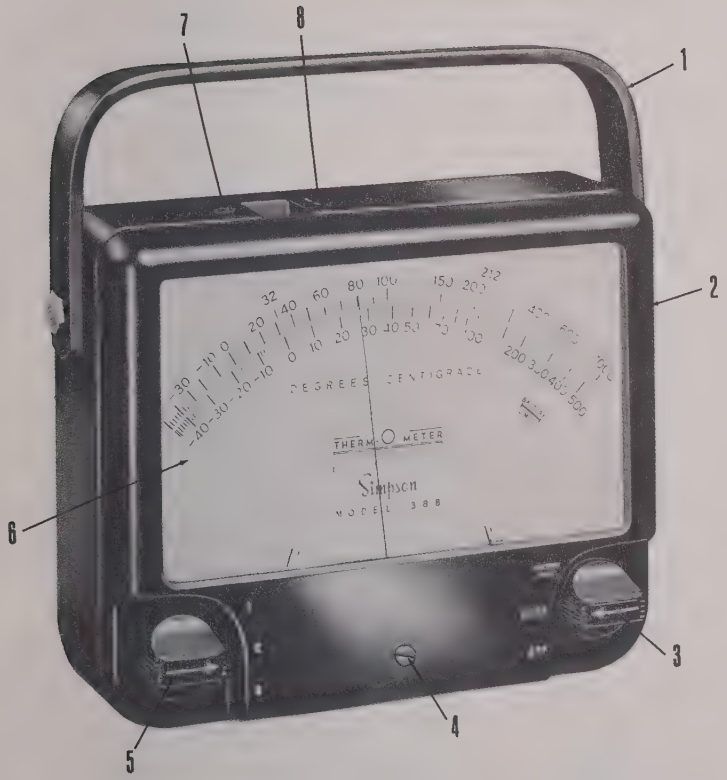

Figure 3-1. Controls, Connectors and Indicator

reading for the actual temperature of the Instrument. The meter responds to the combined voltage from the thermocouple lead and the compensating circuit.

c. BATTERY TEST: This position is used to check the relative condition of the battery. There is a range of indications on the meter that show whether the battery is satisfactory. The spring loading will return the switch to the READ position as soon as the knob is released.

4. Zero Adjuster: Used to correct pointer indication with leads removed and compensation switch (←) in OFF position. Meter must indicate 80°F, if not, correct with zero adjustment (see paragraph 4.6).

5. Thermocouple Selector Switch: → Three position switch (1, 2, 3), used to select which thermocouple is used as a basis of indication. When the switch is at 1, the temperature will be that of the tip of lead 1, etc.

6. Meter: This large 7-inch meter is calibrated in Fahrenheit and Centigrade. The pointer is initially adjusted to 80°F. All indications are read directly.

7. Calibrating Control: Removing the snap button exposes the access hole for the screwdriver-adjusted variable resistor inside the case. This resistor is used for calibrating the Instrument.

8. Input Jacks: These polarized jacks allow the thermocouple leads to be inserted only one way. This prevents incorrect insertion, which would result in wrong readings. The jack numbers on the top of the case correspond with the numbers on the thermocouple selector switch →.

SECTION IV

OPERATION

4.1 GENERAL

This section of the manual contains the operating procedures for the Model 388-3L Therm-O-Meter.

4.2 CONNECTING THE LEADS

a. Insert the polarized plug, at the end of the test lead, into the Input Jack (see Figure 3-1). It can only be inserted in one direction.

NOTE: Connect one, two or three leads. Be sure the position of the thermocouple selector switch (→) corresponds with the lead that is to be monitored.

b. Place the tip of the lead in the area that is to be temperature tested. You may have to tape it or clamp it in position. When testing a liquid be sure to allow at least two inches at the end of the lead to be immersed in the liquid.

NOTE: Keep the lead wound in a flat coil shape when not in use. Do not kink the lead or cut off any unused excess as this will affect the resistance of the lead and the accuracy of the reading.

c. After the leads are removed from a liquid be sure to dry the tip and insulation before making a "dry bulb" measurement. Indications will be lower while evaporation is taking place.

NOTE: Certain liquids will have a corrosive action on the tip. Be sure to rinse and dry the tip to retard corrosion and prevent rusting thereby prolonging the life expectancy and usability of the tip.

4.3 NORMAL OPERATION

a. Place the Instrument in any convenient location where the temperature is between 60° and 100°F (15° and 39°C).

b. Place the lead tip (probe, thermocouple etc.) at the point that is to be measured (inside a furnace, refrigerator, under the surface of a liquid, surface of a heat sink or electronic component etc.).

c. Set the compensating circuit switch (←) to the READ position.

d. Note meter indication. Pointer will show temperature that is present at the probe (tip of lead, thermocouple).

e. If the battery voltage is below its normal range, determine the meter temperature and make the following adjustments:

   1. Place the compensating circuit switch (←) to OFF.

   2. Read the meter, but, correct the reading by adding or subtracting the difference between the meter operating temperature and 80°F, use this figure when correcting the readings on the centigrade scale.

NOTE: Always return the compensating circuit switch to the OFF position between readings during Normal Operation. This prevents a drain on the batteries and prolongs battery life.

4.4 ABNORMAL TEMPERATURE OPERATION

(below 60°F or above 100°F)

a. Place Instrument in test location.

b. Place the lead tip at the point to be measured.

c. Set the compensating switch (←) to READ.

d. Observe indication. The compensating circuit will not fully correct for the instrument temperature. Error will be in proportion to the number of degrees that the instrument operating temperature is from 60° to 100°F. Example: a 20° lower-than-normal temperature results in an error of approximately 3° to 6°, while a 60° below normal operating range would result in an error of 15°F or more.

4.5 LARGE TEMPERATURE DIFFERENCE

When transferring the Instrument from one location to another, where there is a large difference in temperature, it is necessary for the meter to stabilize to the new temperature environment before attempting to make accurate measurements. This may take from a few minutes to an hour or more, depending on the temperature difference involved and the accuracy required.

4.6 BATTERY TEST

Before each use, or at least once a day when the thermometer is used constantly, check to see that the compensating battery is within limits.

a. Plug the thermocouple lead into the jack.

b. Place the probe tip near the plug end so both ends come to the same temperature and the lead does not furnish a deflecting voltage.

c. Place compensating circuit switch (←) in the BATTERY TEST position and hold. This is a spring loaded position and the switch will only remain in this position as long as it is held there.

d. Check the Instrument indication. Pointer should be in area designated as BATTERY LIMITS. Within these limits battery has enough energy for compensating circuit. If the pointer is below these limits the battery terminal voltage is too low and a battery replacement is indicated. See Section V for replacement information.

4.7 ZERO ADJUSTMENT

Periodically check for zero setting.

a. Remove the test lead (or leads) from the Instrument.

b. Turn the compensating circuit switch (←) to the OFF position.

c. Check the meter indication, it should read 80°F.

d. If indication is off: Using a small screwdriver, slowly turn the zero adjustment screw clockwise or counterclockwise until the pointer is at 80°F. This is the pointer position for zero current through the meter.

4.8 WET BULB TEMPERATURES

The Model 388-3L is a very convenient instrument to use for measuring wet bulb temperatures. Wrap some string or wicking around the end of the test lead and dip it in water to wet it thoroughly. Then swing it back and forth gently to evaporate water from the lead tip. Since the Instrument remains in a stationary position, you can read the exact wet bulb temperature while con-

tinuing to swing the lead tip. Be careful to prevent kinking the lead as it is swung back and forth.

NOTE: After making a wet bulb reading, remove the string wrapping and dry the lead tip thoroughly before attempting to make a dry bulb reading. If any moisture remains on the lead tip or in the insulation, this will lower the dry bulb reading.

4.9 STANDARD TYPE THERMOCOUPLE LEAD

There are several accessory items available for obtaining the best service from your Instrument (see Table 6-2). Additional standard type thermocouple leads can be obtained for use with the Model 388-3L (see Tables 7-1 and 7-2). Figure 4-1 shows thermocouple lead Catalog No. 0190. Refer to paragraphs 4.3 to 4.7 for procedures.

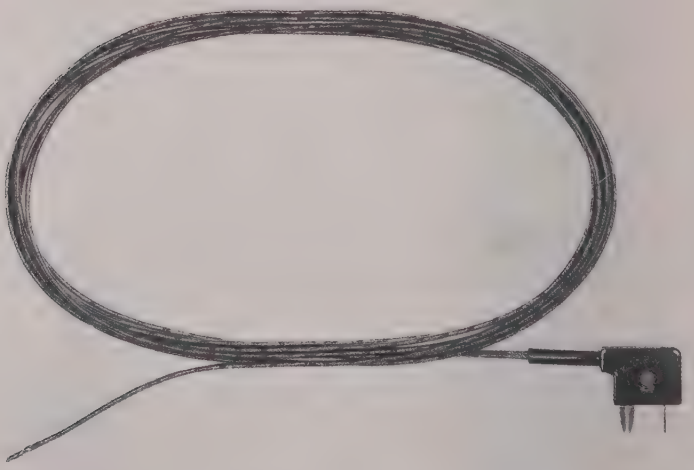

Figure 4-1. Standard Type Thermocouple Lead, Catalog No. 0190

4.10 SURFACE TYPE THERMOCOUPLE LEAD

4.10.1 A special type of lead is available to use in measuring a surface temperature, such as the outer wall of a container. This surface type thermocouple lead (see Figure 4-2) is 8 feet long. The thermocouple element is enclosed in a bakelite sleeve (probe) and a Teflon insulator. A small copper contactor is imbedded in the plastic end and transmits the heat back to the thermocouple junction inside the insulator. The other end of this lead is fitted with a plug that fits the regular jack. Surface temperatures up to 1000°F can be measured with this lead.

Figure 4-2. Surface Thermocouple Lead Catalog No. 0187

4.10.2 The surface thermocouple lead is constructed so that the surrounding temperature has no influence on the thermocouple and thus provides a temperature reading of the surface only. To use the surface thermocouple lead:

a. Plug the connector into the Model 388-3L.

b. Hold the probe tip of the lead against the surface to be measured for 10 to 20 seconds, or until the meter pointer comes to a complete rest; then read the temperature.

CAUTION

The material supporting the copper contactor in this probe softens at temperatures in excess of 600°F. When making measurements at temperatures above 600°F apply just enough pressure to maintain contact with the surface being checked and thus avoid distortion and damage to the probe.

c. The life of the probe is shortened by exposure to temperatures above 600°F. See Table 4-1 for estimated minimum probe life and recommended maximum continuous use time.

Table 4-1. Surface Thermocouple Probe Life Temperature

Temperature	Maximum Continuous Usage Recommended	Probable Probe Life
700°F	2 hrs.	5000hrs.
800°F	15 min.	100 hrs.
900°F	3 min.	1 hr.
1000°F	1 min.	.5 hr.

4.11 RUGGED SERVICE TYPE THERMOCOUPLE LEAD

In many applications, particulary where abrasion of the insulation can occur, the life of the standard lead will be relatively short. For these applications, a lead having a flexible steel jacket (such as the rugged service type, see Figure 4-3), has been designed. Temperature measurements can be continuously monitored within the maximum limits of this tester without any detrimental effects to the steel jacketed leads. Use in the same manner as the standard thermocouple lead.

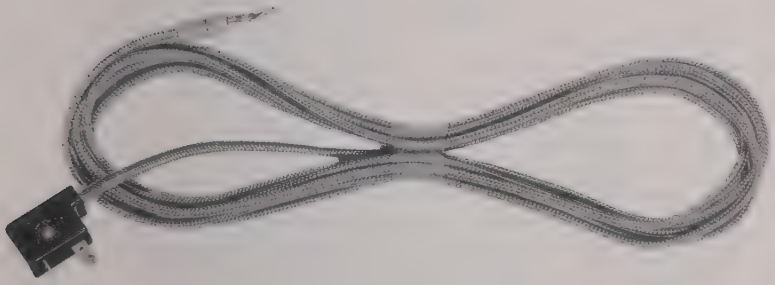

Figure 4-3. Rugged Service Type, Thermocouple Lead

SECTION V

THEORY OF OPERATION

5.1 THERMOCOUPLE OPERATION

5.1.1 The thermocouple lead consists of two wires (with fiberglass inculstion) that are made of two metals, one iron and the other constantan, and are joined together and welded at the tip. This is the thermocouple, or thermocouple junction.

5.1.2 A temperature difference between the two ends of this lead develops a DC voltage difference between the constantan and the iron. When the temperature at the tip is higher than the temperature at the plug end of the lead, the voltage is positive on the iron wire and negative on the constantan. The polarity reverses (the voltage is negative on the iron wire and positive on the constantan) when the temperature at the tip is lower than at the plug end. As the temperature difference increases the voltage increases between the wires. This voltage is applied to the meter circuit to deflect the pointer and indicate the temperature. There is no voltage difference on the wires when the temperature is the same at both ends of the lead and the meter pointer remains at its zero or 80°F point.

5.2 CIRCUIT OPERATION WITH NO COMPENSATION

5.2.1 Figure 5-1 is a simplified diagram of the meter circuit when the compensating switch is "OFF." When no voltage is generated in the thermocouple lead, the pointer remains at its zero indication point of 80°F because there is no current flow.

5.2.2 The bridge circuit is in parallel with the meter and the thermocouple but it has a negligible effect on the meter reading. This can be easily understood if you consider the value of the bridge resistors and compare them to the low value of the thermocouple (2.9Ω and the meter 8.2Ω). Most of the current will flow from the thermocouple through the meter to the NTC resistor and back to the thermocouple or vice-versa. Current flow is determined solely by the potential developed by the thermocouple. If there is a

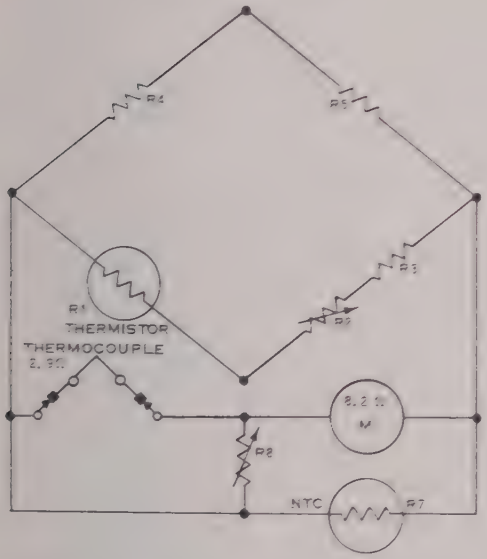

Figure 5-1. Simplified Diagram, With No Compensation

temperature difference between the leads, the meter pointer will deflect from 80°F. Any variation in temperature will cause a deflection but the reading will be uncompensated while the switch is in the OFF position.

5.3 BRIDGE CIRCUIT OPERATION

5.3.1 Figure 5-2 shows the bridge circuit function when the switch is in the READ position. Any variation in temperature away from 80°F changes the resistance of the thermistor and unbalances the bridge. The polarity and amount of voltage difference between the two contacted points sends current from the battery through the meter, which in turn deflects the pointer in the direction and amount to correct the meter indication.

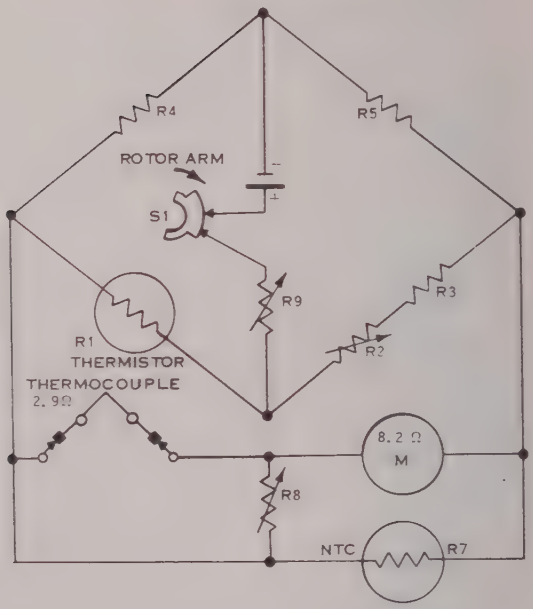

Figure 5-2. Simplified Diagram of Compensating Circuit

5.3.2 Current through the meter is due to both the thermocouple and the bridge circuit. The result will be an indication of the temperature present at the tip of the lead.

5.3.3 When the bridge temperature is 80°F it is electrically balanced and there is no difference in voltage between the two points where the meter is connected. The meter remains at its zero or 80°F point. Unless the thermocouple lead is plugged in, there is no path (to the meter) for the compensating current to flow through. The 2.9 ohm lead resistance must be in the circuit before the compensating circuit will work. It is also necessary for the battery test, or a 2.9 ohm resistor must be substituted for the lead.

5.4 BATTERY TEST CIRCUITRY

S1 is a shorting type switch, the bridge circuit and the battery test circuit function during the test. When switch S1 is in this position, current will flow in the meter circuit from the battery. The amount of current flowing depends on the condition of the battery. The scale is marked for battery test. As previously stated, the thermocouple lead must be plugged in, or a 2.9Ω resistor substituted for the lead, or the reading will be unsatisfactory. Note that there are several parallel return paths to the battery, the meter and the thermocouple being the lowest values in the circuit. Thus, if the thermocouple is removed most of the current will flow through the meter and give an erroneous reading.

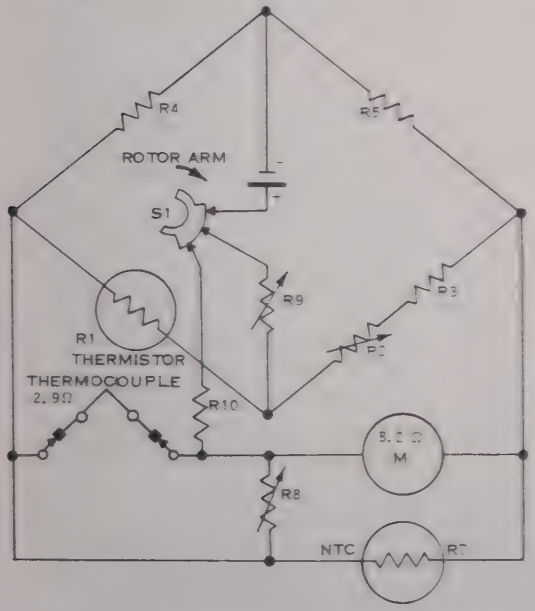

Figure 5-3. Simplified Diagram of Battery Test Circuit

SECTION VI

MAINTENANCE

6.1 GENERAL

The Model 388-3L is carefully designed and constructed with high quality components. By providing reasonable care, and following the instructions in this manual, you can expect a long useful service life from this Instrument.

6.2 WARRANTY

The Simpson Electric Company Warranty Policy is printed on the front cover of this manual. Read carefully before requesting a warranty repair.

NOTE: For assistance of any kind, including help with the instrument under warranty, contact the nearest Authorized Service Center listed on the last pages of this manual or contact the Factory Service Manager. Give full details of the difficulty and include the model and serial number of the unit and date of purchase. Shipping instructions will be promptly sent to you. If an estimate of charges for non-warranty work or other service work is required, a firm quote estimate will be furnished upon receipt of the unit. Service work will not be performed without customer approval.

6.3 CARE OF THE THERMOCOUPLE LEAD

The thermocouple lead is made of two wires, one iron and the other constantan. There are two layers of insulation. One layer of spun glass covers each wire and another layer covers the pair. Each lead length is approximately 8 feet overall, and should remain that length to produce accurate temperature indications. The lead resistance is a part of the circuit resistance through the indicating meter, so any change in length will change the electrical resistance in the meter circuit, and change the resulting temperature and battery test indications.

6.4 STORING THE LEAD

When the thermocouple lead is not in use, keep it rolled in a flat coil to prevent accidental damage. Do not kink the lead with a sharp bend. The two metals of which the wires are made are somewhat brittle, and will either break at the sharp bend, or will partially break and increase lead resistance.

6.5 USING DAMAGED THERMOCOUPLE LEAD

If the lead tip has been damaged by continued application of high temperatures and the insulation has melted away, the lead may still be used. Be sure the two wires are separated from each other except where they are welded together to form the junction.

6.6 BATTERY CARE

a. The Model 388-3L uses a 1.5-volt battery, No. 2, size D. As mentioned earlier, the battery strength will decrease over a period of time. When the terminal voltage decreases, the amount of compensating current will decrease correspondingly. To maintain the desired accuracy of indications, be sure the battery condition is within the established tolerance which will provide the right amount of temperature correction on the meter.

b. Check battery frequently, replace battery when dead.

6.7 BATTERY TESTING

a. To check the battery, connect a thermocouple lead to the meter circuit and place its thermo-junction in the center eyelet of the thermocouple plug. If necessary, wait for the two ends of the lead to come to the same temperature.

b. Turn the compensating switch (←) to BATTERY TEST. The meter pointer will deflect to indicate the terminal voltage available from the dry cell. There is a special scale on the dial marked BATTERY LIMITS. When the pointer shows that the terminal voltage has reduced below the allowable limit, replace the dry cell with a fresh one.

6.8 BATTERY REPLACEMENT

a. Remove the four screws through the back of the case and pull the case straight back from the front panel. The case separates just in front of the jack for the thermocouple leads. Do not pull the case at an angle. The battery is located in a compartment inside the Instrument which is especially designed to hold it and provide a contact for the two terminals.

b. To remove the battery, pull it straight out of the compartment. When replacing it, be sure to observe polarity. The compartment is identified with + and − markings to coincide with the positive and negative sides of the battery.

c. After the battery has been replaced, insert the case over the Instrument. Be careful, slide the case straight and not at an angle.

6.9 PARTS REPLACEMENT

Whenever any resistors or other parts (except the battery or leads) are replaced in the Therm-O-Meter, recalibrate the Instrument with the calibration procedure.

NOTE: For maximum accuracy, the Instrument should be returned to the factory or the nearest Simpson Authorized Service Center for repair and recalibration. However, if the time is of essence and depending on the extent of the repair required, the General Calibration Procedure in paragraph 6.10 is recommended.

6.10 GENERAL CALIBRATION PROCEDURE

6.10.1 Requirements

a. To duplicate factory accuracy, the Instrument and its thermocouple lead must be placed in a room or into a cabinet in which the temperature is kept under control. The three test temperatures are exactly 80°F, and approximately 60°F and 100°F, and these temperatures must be held constant through periods of two or more hours.

b. Take two containers. Fill one container with ice water (it should be at least 50% ice at time of use). Fill the other container with boiling water. These two requirements must be provided to obtain maximum accuracy during test.

c. Use two standard thermometers for comparison of indications. Tape one thermometer to the meter cover to read the Instrument temperatures in the test room or cabinet at 60°, 80°, and 100°F. Place the other standard thermometer in the same position as the lead tip to check temperatures from 32° to 212°F. Calibration accuracy is determined by the accuracy of the standard thermometers.

NOTE: Avoid touching or handling the lead or the instrument unnecessarily during the calibration procedure. Body temperature is different from any of the controlled temperatures to which the Instrument and lead are subjected, and will cause a temperature variation each time you touch them.

6.10.2 Balancing the bridge in the compensating circuit:

a. Perform the zero Adjustment Procedure in paragraph 4.6.

b. Connect a lead to the Instrument, set the thermocouple selector switch (→) to connect the thermocouple lead to the instrument circuit.

c. Place the Instrument and the thermocouple lead in a temperature controlled cabinet, or room set for exactly 80°F. Allow 1 to 2 hours for the entire Instrument and the thermocouple lead to become stabilized at this temperature.

d. Set the compensating switch (→) to READ. Observe the meter indication. It should read 80°F.

e. If it does not read 80°F, remove the back cover and use a screwdriver to adjust potentiometer R2 (located two inches from the bottom edge of the panel), until the meter indicates correctly.

6.10.3 Adjusting the compensating circuit sensitivity:

a. Repeat procedure in paragraph 6.10.2 (with room temperature at 100°F instead of 80°F).

b. Observe the meter indication. It should equal the standard thermometer reading, which is affected by th same controlled temperature.

c. If necessary, using a screwdriver adjust the potentiometer R9 (located closest to the battery) to correct the temperature indication on the Therm-O-Meter.

d. Reduce the controlled temperature to about 60°F. Allow one to two hours for the Instrument and lead to become stabilized at this temperature.

e. Observe the meter indication again. It should be the same as that shown on the standard thermometer which is affected by the same controlled temperature.

f. If necessary, compromise the setting of potentiometer R9 to average the 60°F accuracy with that at 100°F.

6.11 FINAL CALIBRATION

a. Stabilize the Instrument and thermocouple lead at room temperature, between 75°F and 85°F.

b. Place the end of the lead in the mixture of ice water with at least two inches of the end of the lead in water. Stir the water to maintain a constant temperature and measure it with the standard thermometer at the point where the sensing end of the thermocouple lead is submersed.

c. Adjust the calibrating resistor R8 (located near the lead jack) until the meter reads the same as the standard thermometer. This will be near 32°F, but may vary one to two degrees due to barometric pressure and impurities in the water and the ice.

d. Remove the lead and the standard thermometer from the ice water and transfer them to the container of boiling water.

e. After the temperature indications have been stabilized, compare the meter indication with the thermometer reading. They should read the same temperature. If there is any difference, readjust calibrating resistor R8 to average the accuracy for ice water and boiling water.

NOTE: There is no adjustment for the battery test circuit. A fresh battery should cause the meter to indicate within the upper two thirds of the BATTERY LIMITS area when the thermocouple lead is plugged in and the thermocouple tip and the meter are at the same temperature. If the thermocouple lead is not used, substitute 2.9 ohms of resistance for the lead. Either one or the other must be in the circuit to obtain a satisfactory reading. The thermocouple lead must not furnish any voltage during the test or it will affect the accuracy of the battery test.

SECTION VII

ORDERING INFORMATION, SCHEMATIC DIAGRAM AND AUTHORIZED SERVICE CENTERS

Table 7-1. Instrument and List of Items Furnished

Description	Part No.
Model 388-3L	Cat. No. 12460
Thermocouple Lead, Standard Type	Cat. No. 0190
Operator's Manual	1-110224

Table 7-2. Optional Accessories

Description	Part No.
Carrying Case	Cat. No. 5262
Thermocouple lead, surface type	Cat. No. 0187
Thermocouple lead, rugged service type	Cat. No. 0496

Table 7-3. Replacement Parts

Symbol	Description	Part No.
R1	Thermistor, approximately 100Ω at 80°F	1-113771
R2	Potentiometer, 400Ω	1-113774
R3	Resistor, 680Ω, ±1%, 1/2W	1-115243
R4	Resistor, 510Ω, ±1%, 1/2W	1-115242
R5	Resistor, 510Ω, ±1%, 1/2W	1-115242
R7	Resistor, N.T.C., 2.75Ω, at 80°F	1-112271
R8	Potentiometer, 100Ω	1-114224
R9	Potentiometer, 1000Ω	1-114525
R10	Resistor, 100Ω, ±1%, 1/4W	5-113141
S1	Switch, compensating	1-115245
S2	Switch, circuit selector	1-110584

Knob, switch, with white arrow	1-110717
Case back, finished	3-330075
Thermistor clamp	3-160064
Thermistor holder	3-160065
Jack assembly	10-890189
Thermocouple lead, standard type	Cat. No. 0190
Battery, 1.5V "D" size cell	1-111798

Burgess No. 2 — Obtainable locally
NEDA No. 13C — Obtainable locally
Eveready #950 — Obtainable locally

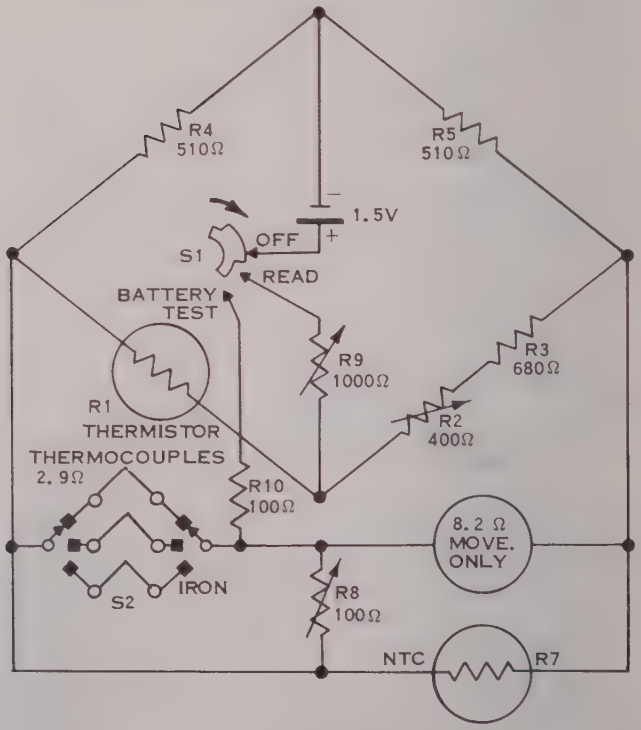

Figure 7-1. Model 388-3L, Schematic Diagram

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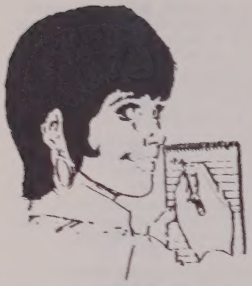

NOTES

FOR THE RECORD

Date Purchased _____

Purchased From: _____

Identification Number: _____

_____

Date	*Type of Service*	*Serviced By*
_____	_____	_____
_____	_____	_____
_____	_____	_____
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